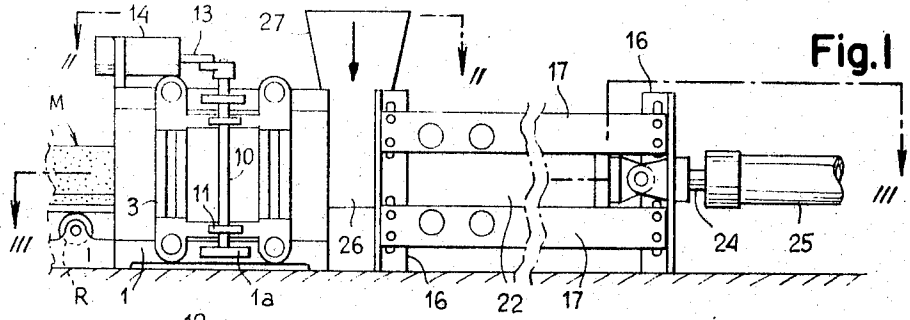
Feb. 21, 1967 M. FATTIROLLI 3,304,592

MACHINE WITH MOLD-SECTION-VARYING MEANS FOR MANUFACTURE OF CONCRETE ARTICLES THROUGH SUBSEQUENT COMPRESSION STATES

Filed Feb. 12, 1964

3 Sheets-Sheet 1

Fig. 1



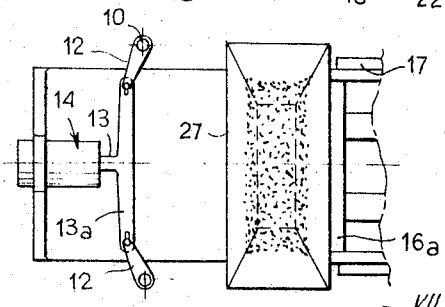
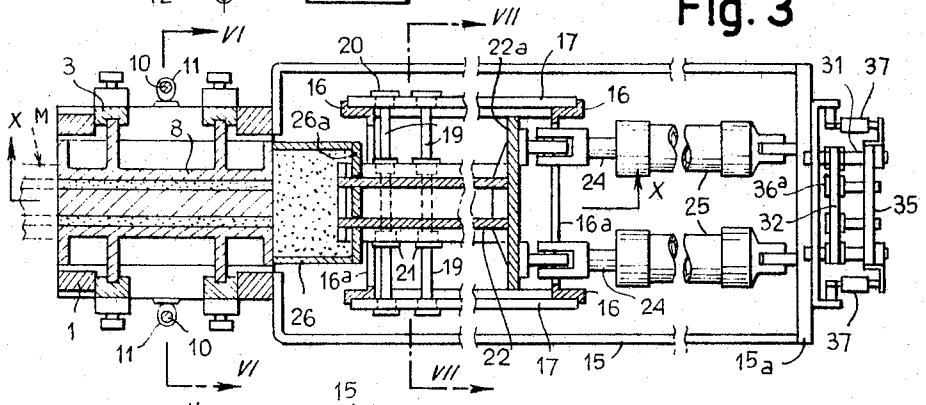


Fig. 2

Fig. 3



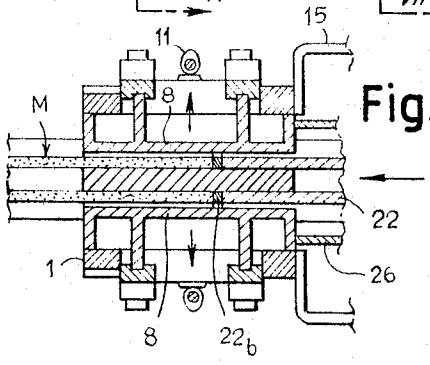


Fig. 4

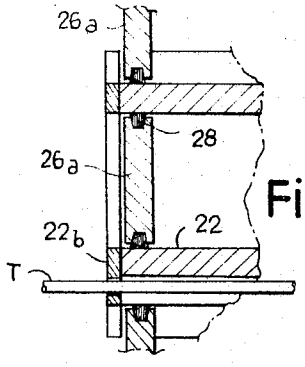


Fig. 5

INVENTOR
MARIO FATTIROLLI
BY Hopgood & Calimafde
ATTORNEYS

Feb. 21, 1967 M. FATTIROLLI 3,304,592

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Filed Feb. 12, 1964 3 Sheets-Sheet 2

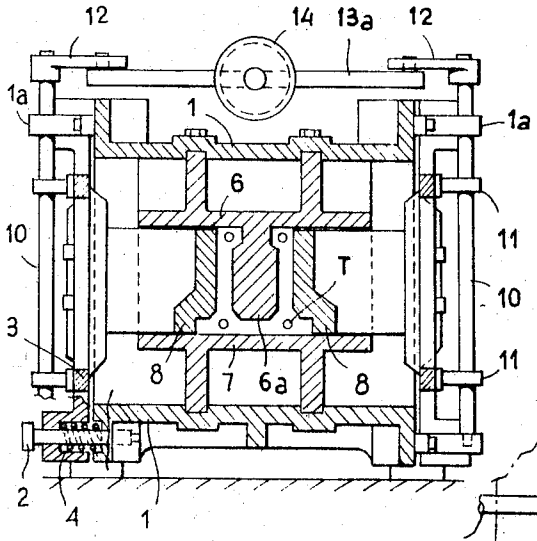


Fig. 6

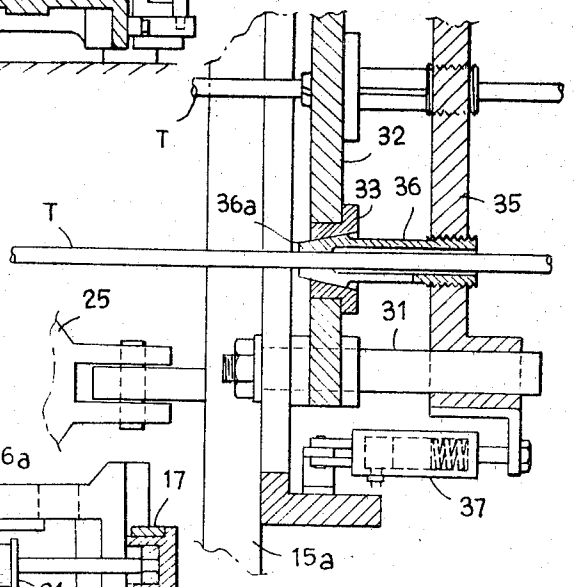
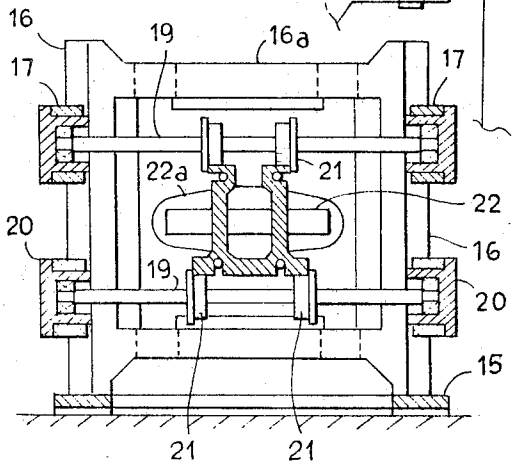


Fig. 9

Fig. 7



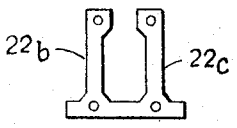


Fig. 8

INVENTOR
MARIO FATTIROLLI
BY Hopgood & Calimafde
ATTORNEYS

Feb. 21, 1967 M. FATTIROLLI 3,304,592

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Filed Feb. 12, 1964 3 Sheets-Sheet 3

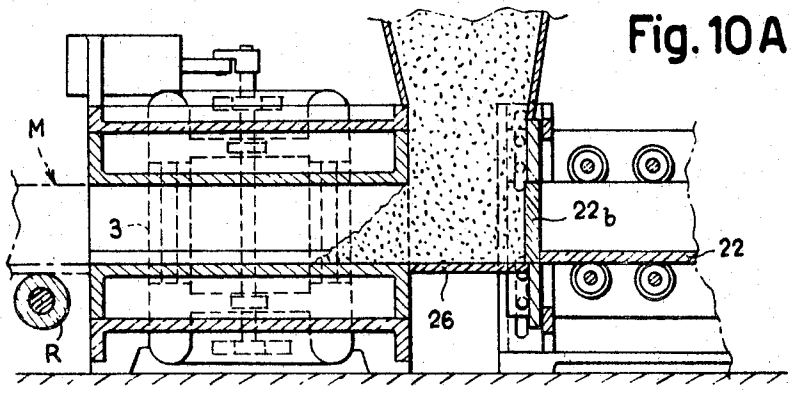


Fig. 10A

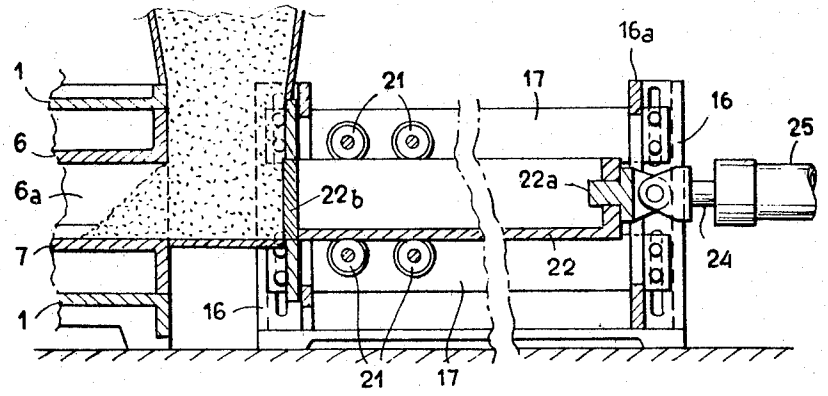


Fig. 10B

INVENTOR
MARIO FATTIROLLI
BY Hopgood & Calimafde
ATTORNEYS

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3,304,592

MACHINE WITH MOLD-SECTION-VARYING MEANS FOR MANUFACTURE OF CONCRETE ARTICLES THROUGH SUBSEQUENT COMPRESSION STATES

Mario Fattirolli, Via del Ninfale 2, Florence, Italy

Filed Feb. 12, 1964, Ser. No. 344,463
4 Claims. (Cl. 25—41)

The invention relates to a machine for the manufacture of a cement or concrete article or other similar materials, having a relatively very high or even unlimited length. In particular, but not exclusively, the machine according to the invention is designed for the manufacture of prefabricated beams and bars, also eventually provided with a longitudinal reinforcement. The manufacturing method according to the invention provides substantially for the forming or moulding of an article having an unlimited length through subsequent compressions of unit loads of material and corresponding subsequent advancements of the portion of material already moulded each time by the amount of moulded article with the compression of each unit load.

The machine according to the invention substantially includes, in combination with a pressing piston means and with means apt to supply the material loads, a mould open both at the front end from which the pressing piston penetrates therein, and at the opposite exit (rear) end, while the cross-section of said mould is made variable in order to obtain a variable reaction of lateral friction so as to allow the intermittent feed or advancement of the article being moulded with a frequency corresponding to the pressing piston operational frequency.

In the practical embodiment, said mould is set up by several lateral sectors, some at least of which capable of movements of separation and of approach with respect to the position, in which they cooperate for the definition of the cross-section of the article to be produced. For instance, a mould may involve four lateral sectors, two of which in opposition are capable of movements of symmetrical separation and approach, one at least of the other two stationary sectors may involve a core to define an open longitudinal cavity in the article. In certain cases, also a core may involve movable lateral sections for the same purposes. A core may also be provided to form an annular cross-section article and in this case the core is supported by the piston.

The mould movable sectors may be hinged to the stationary structure or guided to slide parallel thereto in a direction orthogonal to that of the intermittent advancement of the article being moulded.

A machine for the manufacture of cement, concrete articles or the like, even eventually in tiles, having an unlimited length, according to a possible embodiment, may include: a stationary structure supporting stationary sectors of a continuous mould; guide means to substain movable sectors of a continuous mould designed to cooperate with said stationary sectors to form a mould open at a front end and at a rear end; means to obtain cyclically the branching-off of the movable sectors to increase the mould cross-section with respect to that of the article being formed; means to accomodate the article being formed emerging out of the mould rear end; a loading hopper combined with the mould front end; on the stationary structure, guide means for a piston member capable of passing through said loading hopper to penetrate into the mould from its front end; control means for the piston pressing stroke and control means for the opening of the mould movable sectors synchronized with the control means of the piston.

The machine may also include means designed to allow the introduction of metal rods or wires reinforcement elements into the continuous mould to set up the longitudinal reinforcement of the article being moulded; the rods are moved with the intermittent feed or advancement of the article and retained by appropriate clamps during the loading and pressing stages, that is, during the periods in which the article being moulded is kept still.

For the initial forming of the continuous article, or also for the forming of single limited length articles, provisions may be made for the use of a contrast member at the rear end, that is, at the mould exit. In this way, it is possible to make the pressing of the initial portion of an unlimited length article, or elements having a reduced length, such as bricks, blocks or the like, may be made.

The drawing illustrates an embodiment not restricting the carrying out of the invention. In the drawing:

FIGS. 1, 2 and 3 illustrate a side view of the machine, a partial plant view taken along the line II—II of FIG. 1; and a section taken along the line III—III of FIG. 1, in the arrangement in which the mould is closed;

FIG. 4 partly illustrates a view similar to FIG. 3, with the mould having the movable sectors open;

FIG. 5 illustrates an enlarged detail of FIG. 3;

FIGS. 6 and 7 are enlarged cross-sections taken along the lines VI—VI, and VII—VII of FIG. 3;

FIG. 8 illustrates a front view of the piston operative end;

FIG. 9 illustrates an enlarged detail and in section of a device for the locking of the longitudinal reinforcement rods;

FIGS. 10A and 10B illustrate two portions of the longitudinal section taken along the line X—X of FIG. 3.

According to what is illustrated in the accompanying drawings, 1 generically denotes a stationary structure, which carries on the two sides, upperly and lowerly, horizontal guide stems 2, in the number of four for each side; a slidable frame 3 is slidably assembled on the stems 2 arranged on each side, and said frame is urged by springs 4 in such a direction to be separated from the opposite frame 3. Two mould stationary sectors, 6 and 7, upper and lower, are applicable to the structure 1; these stationary mould sectors are replaceable to modify the mould according to the cross-section of the article to be made. Corresponding mould movable sectors 8, also replaceable, are applicable to the frames 3. The upper stationary sector 6, according to the drawing, also forms a core 6*a*, which is extended towards the stationary sector 7, between the two movable sectors 8.

On the stationary structure 1, by means of supports 1*a*, two vertical shafts 10 are mounted on the outside of the structures 3, each shaft bearing a pair of cams 11. The two shafts 10 are simultaneously operable through cranks 12 by the T cross-bar 13*a* of the stem 13 of a piston forming a part of a cylinder-piston system, whose cylinder 14 is located on the structure 1.

The arrangement of the springs 4 and cams 11 determines the simultaneous and symmetrical control of the movable mould sectors 8, from a closed position shown in FIGS. 3 and 6, to an open position shown in FIG. 4. The cams 11 determine the mutual approach of the mould sectors 8 and the springs 4 tend to open them. Therefore a mould open at a feed front end is formed (looking at FIGS. 3 and 4 on the right hand side) and at an exit rear end (on the left hand side looking at FIG. 3 and 4), which would is defined by the stationary sectors 6, 7 and by the movable sector 8 and is thus capable of modifying the cross-section of its own passing cavity.

The stationary structure 1 has combined thereto an additional stationary structure 15, which forms four uprights 16. Pairs of cross-bars 17 may be secured in a vertically adjustable position on these uprights and said

cross-bars are capable of being moved into the vertical position by means of vertical slots cut in the uprights **16**. Said uprights **16** are connected one another by horizontal structures **16***a*. The cross-bars **17** bear a pair of shafts **19**, which are mounted on supports **20** of the cross-bars **17**. These shafts **19** each carry a pair of rollers **21**, the rollers **21** being eight in all. The rollers **21** serve to guide a pressing piston slidably in a horizontal direction in the direction of the longitudinal extension of the above defined mould. The piston **22** bears a rear cross-bar **22***a*, to which are connected by a linkage the stems **24** of the pistons of a pair of cylinder-piston systems for the pressing, whose cylinders **25** are at the opposite end linked to an end wall **15***a* of the stationary structure **15**. The piston **22** has a cross-section substantially corresponding to that of the through cavity formed by the mould **6**, **6***a*, **7**, **8**, **8**; when the mould is modified for the replacement of the replaceable sectors, also the piston **22** may be replaced, and said piston may also be guided by the rollers **21**, along its longitudinal peripheral corners, as the rollers **21** may be moved along the shafts **19** and the shafts **19** may be separated or approached by adjusting the position of the cross-bars **17** on the structure **16**, **16***a*. At the active front end, the piston **22** is provided with a plate **22***b*, which exactly duplicates the profile of the mould cross-section (especially see FIG. 8). The difference between the plate **22***b* and the piston cross-section **22** according to the drawing is only formed by the presence of the holes **22***c* in the plate **22***b*, to allow the passage of metal rods or wires T designed to the article, while in correspondence of the wires, the piston **22** is provided with channels designed to accomodate the same wires.

26 denotes the lower portion of a hopper **27** designed for the loading of the material destined for the moulding or forming of the article; said hopper portion **26** is included between the mould front and the adjacent structure **16**, **16***a*. The wall **26***a* of the hopper section **26**, which is opposite the mould, is provided with an opening corresponding to the piston cross-section, the plate **22***b* thereof being internal to the hopper **26**, **27**; the packings **28** of the walls **26***a* (see FIG. 5) cooperate with the flanks of the piston **22** to assure the seal.

On the outside of the end wall **15***a* of the stationary structure **15** there are provided guide columns **31** (especially see FIG. 9) parallel to the wires T. A plate **32** is connected to the columns **31** in a fixed position, and said plate bears conical clamp seats **33**, through which the continuous wires T pass. A plate **35** is slidably assembled on the columns **31**, and it carries multi-jaws (**36***a*) clamps **36**, having a conical profile and capable of cooperating with the seats **33** to clamp or release the wires T according to the fact that the plate **35** is approached or brought away with respect to the plate **32**; two cylinder-piston double action or simple action systems **37**, with antagonistic springs, are provided to control the movements of the plate **35**. When the article M is being formed, and the material is loaded in the hopper **26**, **27**, to feed the mould, this material is unloaded into the mould cavity as shown in FIGS. 10A, 10B, between the mould end and the portion of material, already formed and pressed. The piston stroke from the rear position of FIGS. 3 and 10A, 10B, through the portion **26** of the hopper to the mould determines the pressing stage of the article, and the mould sectors **8** are in the approached position. The pressing takes place between the plate **22***b* and the end of the article M being moulded, which is located in the mould appropriately spaced from the penetration end of the piston **22**. The article being moulded assures the contrast for the pressing, by effect of the lateral friction with the mould walls, formed by the sectors **6** (with the extension **6***a*), **7**, **8**, **8**; in fact, during the pressing stage, there is no slip of the material M being formed. After effected the pressing of the unit load of material penetrated into the mould by means of the cams **11** and the springs **4**, the

mould movable sectors **8** are opened and the final portion of the stroke of the piston **22** then allows the movement of the article M for a length corresponding to the portion of such article formed or moulded with the same stroke of the piston. Then the piston is withdrawn, the movable sectors **8** are closed and a new load of material is fed from the hopper **27**, **26**. The feed of the material may be facilitated by means of vibration and/or inflation of air or the like. The article M being formed is collected on sliding supporting means such as the rollers R.

For the initial forming of the article, or also for the forming of articles having a restricted length (shaped blocks, bricks, or the like), the application of a contrast member is contemplated at the mould rear end, that is at the end from which the exit of the continuous article is made.

When an article, provided with wires T, is to be moulded, these are assembled by means of the clamps **36**, **36***a*, and through the holes **22***c* of the head plate of the piston **22**. In this case, synchronically with the feed of the cylinder-piston system **14**, the control systems **37** are operated, in such a manner as to unlock the wires T during the advancement stage of the article M, for the purpose of also advancing the wires T without any danger of relative slipping; in all the other stages, the wires are locked in order to avoid any axial movement thereof during the piston strokes for the return and advancement and pressing.

The drawings only illustrate an embodiment which may be varied within the scope of the definition of the invention given by the following claims. For instance, a core may be provided supported by a stay rod anchored to the wall **15***a* and longitudinally passing through the piston; the piston supports said core, whose complete cross-section may be restricted to the interior of the same mould.

What I claim is:

1. In a machine for the manufacture of articles of concrete and like cementitious material,

wall means defining an open-ended mold including at least one longitudinally-extending laterally movable wall part,

means movable longitudinally in said mold to compress said material in the direction from one said open end to the other said open end,

means for moving said compression means within said mold,

means for varying the cross-section of said mold by moving laterally at least said wall part between a predetermined inner position corresponding to the cross-section of the article to be molded and a predetermined outer position, and

means for introducing material to be molded into the cavity defined by the wall means and the compression means,

said compression means being movable longitudinally to mold and compress material when the mold has a cross-section corresponding substantially to the face area of the compression means and said compression means being operable to move the molded article through the mold only when the cross-section of the mold is increased by said mold-section-varying means whereby frictional forces action between the molded material and wall means are substantially reduced.

2. A machine according to claim **1**, wherein said wall means include two said laterally-movable wall parts, at least one of which is mounted for linear movement towards and away from the other said wall part.

3. A machine according to claim **1**, wherein the wall means includes two said laterally-movable wall parts and two fixed wall parts, said mold section-varying means being connected to move two opposite said laterally-movable wall parts towards and away from one another in order to vary the cross-section of the mold.

4. A machine for the manufacture of articles of concrete and other cementitious material, comprising

a stationary structure,

stationary mold members having longitudinal edges, said members being mounted on said stationary structure,

movable mold members having longitudinal edges contiguous with the respective longitudinal edges of said stationary mold members, said stationary and movable mold members together defining an open-ended mold cavity,

cam means arranged to vary the cross-section of the mold by acting to move the movable mold members towards and away from one another between closed and open positions,

a piston having a face area equal to the cross-section of the articles to be molded and movable in said mold cavity,

a loading hopper disposed at the front end of the mold cavity and mounted on the said stationary structure,

guide means for the piston capable of passing through said loading hopper to enter into the mold cavity at the front end thereof,

control means for determining the stroke of the piston,

further control means for opening the movable mold members, and

means for supporting the formed articles when discharged from the mold cavity,

said control means and further control means co-operating to cause the piston to execute a molding and compression portion of its forward stroke with the movable mold members in the closed position and an ejection portion of its forward stroke with the movable mold members in the open position.

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ROBERT F. WHITE, J. A. FINLAYSON, JR., R. D. BALDWIN, *Examiners.*

J. SPENCER OVERHOLSER, *Primary Examiner.*